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(71) Applicant *(for all designated States except US)*: AVESTA NORDS AKTIEBOLAG [SE/SE]; P.O. Box 85, S-660 60 Molkom (SE).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: ARVIDSSON, Thomas [SE/US]; 159 Valley Heights Drive, Williamsport, PA 17701 (US).

(74) Agent: HYNELL, Magnus; Hynell Patenttjänst AB, P.O. Box 2236, S-683 02 Hagfors (SE).

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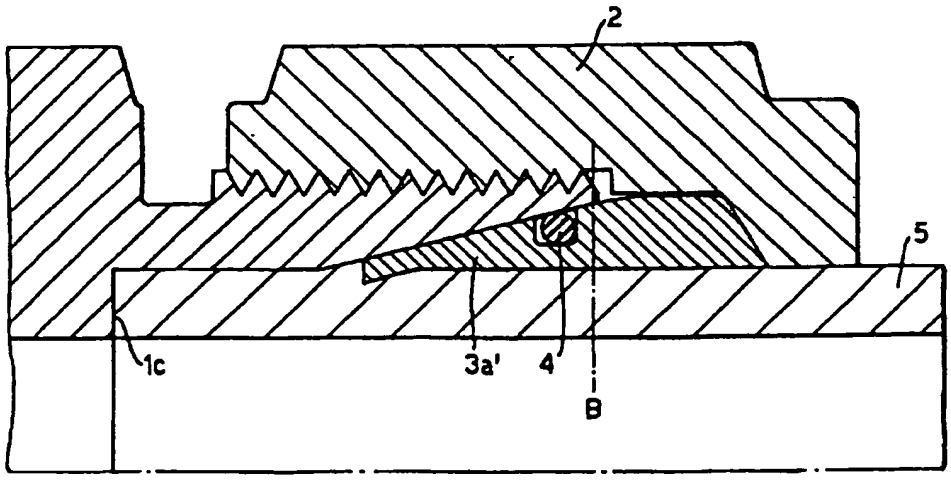

(57) Abstract

A pipe coupling comprising a threaded male part (1) having a part which includes an internal conical surface (1a) and an abutment edge (1c) for abutment with a pipe (5) to be connected to the male part, a threaded female part (2), and a bite ring which is located between the male part and the female part and which includes a press-in part which is adapted to be pressed into the conical part of the male part as the male and female parts are screwed together, such that a front edge (3b) of the press-in part will bite into the pipe extending coaxially with the coupling. The press-in part of the bite ring has externally thereon an annular groove (3g) for accommodating a sealing ring (4) which is pressed sealingly against the internal conical surface of the male part as the male and female parts are screwed together.

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TUBE COUPLING

FIELD OF INVENTION

The present invention relates to a pipe coupling of the kind that includes a threaded male part having a part with an internal conical surface and an abutment edge for abutment with a pipe to be connected to the male part, a threaded female part, and a bite ring which is located between the male part and the female part and which includes a press-in part which is adapted to be pressed into the conical part of the male part as the male and female parts are screwed together, such that a front edge of the press part will bite into the pipe extending coaxially with the coupling.

DESCRIPTION OF THE BACKGROUND ART

Couplings of this kind have long been used to provide a sealed connection between pipe and other components, without needing to pre-work the pipe. One example of a development of a still older basic principle is disclosed in SE-B-333 851. Couplings of this type are based on the fundamental principle whereby the press-in portion of the bite ring is pressed into the conical part of the male part as the coupling is tightened, wherewith the outer surface of the press-in portion slides against the conical outer surface of the male part while generating between the surfaces a pressure of such high magnitude as to cause the front edge of the bite ring to bite into the pipe extending coaxially with the coupling. There are created in this way two sealing surfaces, one sealing surface which is located between pipe and bite ring, this seal being extremely tight by virtue of the fact that the surfaces in the region of the pointed part of the bite ring are totally plasticized, and one sealing surface between the bite ring and the conical inner surface of the male part. This latter seal, however, is highly sensitive to irregularities in the surface where no true plasticization has taken place but where heavy scratches, scores, and surface irregularities have been caused as a result of the surfaces sliding against one another as the coupling is tightened. In addition, the pressure of the medium in the pipe generates a reaction force which strives to push out the pipe and therewith reduce the tightening force. While sealing between pipe and bite ring is further enhanced in this way, it can create a serious problem with regard to sealing between bite ring and the conical inner surface of the male part at high medium pressures.

The use of elastomeric sealing rings, eg rubber sealing rings, normally O-rings, to obtain a good seal is also generally known to the art. US-A-4 258 943 shows some examples of how O-rings can be placed in different couplings. In order for an elastomeric sealing ring to provide an effective seal against high fluid pressure, it is necessary to fulfill a number of basic conditions. One condition is that there must be no clearance between the surfaces where the O-ring is placed. Otherwise the flexible O-ring will be pressed out of its accommodating groove by the pressure of the fluid. Another condition is that the surface against which the sealing ring is pressed is very smooth and has not been seriously scratched or scored. The sealing ring itself must also be whole and undamaged. It would therefore appear that the conditions prevailing in the case of a bite ring are unfavourable to the function of an O-ring or to the function of any other elastomeric sealing ring.

SUMMARY OF THE INVENTION

The object of the invention is to provide a highly sealing- effective pipe coupling of the kind defined in the preamble. More particularly, the object is to provide an effective seal at very high medium pressures and vibrations in pipelines. Another object is to provide a pipe coupling that is comprised essentially of standard components. These and other objects are achieved with a pipe coupling that has the characteristic features set forth in the following claims. Further characteristic features and aspects of the invention will be evident from the following description of a preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWING.

The invention will now be described with reference to a preferred embodiment of an inventive pipe coupling and also with reference to the accompanying drawing, in which

Fig. 1 is a cross-sectional view of a coupling-half and a pipe-half, with the centre line indicated; and

Fig. 2 is a cross-sectional view of the half-coupling and half-pipe after having tightened the thread connection.

DESCRIPTION OF A PREFERRED EMBODIMENT

The main parts of the coupling comprise a threaded male part 1, a threaded female part 2 in the form of a tightening nut which coacts with the male part, and a bite ring 3, wherein all of said parts are penetrated by the pipe 5 to be coupled in abutment with an abutment edge 1c on the male part 1.

As will be seen from Fig. 1, the bite ring 3 includes a press-in part 3a which is intended to be pressed into the male part 1, which has an inner conical mantle surface 1a, such as to deform the press-in part 3a. The deformed parts have been identified in Fig. 2 with the addition of a prime.

The inner conical mantle surface 1a of the male part has a fist slope angle v1. The bite ring 3 has an edge 3b furthest forward of the ring and the region located nearest the edge 3b is designated the pointed part 3c. Prior to deformation of the bite ring 3, this pointed part will have a mantle surface of the same slope angle v1 as the inner conical mantle surface 1a of the male part 1. The remainder of the press-in part 3a, which extends from a bend 3d on the bite ring rearwardly to a rear cylindrical part 3g, has a conical mantle surface 3e whose slope angle v2 is smaller than the first slope angle v1. This means that a first wedge-shaped (in cross-section) gap 6 will be formed between the conical mantle surface 1a of the male part and the mantle surface 3e of the press-in part 3a rearwardly of the front pointed part 3c. The mantle surface 3e of the press-in part 3a includes an O-ring groove 3g which accommodates an O-ring 4. The width of the groove 3g is greater than the diameter of the O-ring 4.

The bite ring 3 also typically includes an inner conical part having a rearwardly sloping conical mantle surface 3h such as to form a second wedge-shaped (in cross-section) part 7 between said inner conical surface 3h and the pipe 5 in a known manner. The sum of the second angle v2 and the wedge angle v3 (or its complementary angle) is typically equal to the first angle v1. The wedge-shaped part 7 extends to a plane B which extends perpendicular to the coupling centre line 8 and which forms the base for the region of bite ring deformation. By "base for the region of bite ring deformation" is meant that those parts located forwardly of the base plane B will be deformed and/or pressed-in against or into the pipe whereas remaining parts,

ie those located rearwardly of the base plane (to the right of the plane B in Fig. 1) will remain intact.

The O-ring groove is placed forwardly of the base plane B. More specifically, in the case of the illustrated embodiment the O-ring groove 3g is spaced forwardly of the base plane B by a distance which may be smaller than the width of the groove 3g, at least in the case of small pipe dimensions (to which the illustrated embodiment relates). When the bite ring 3 has been inserted and its press-in part 3a located in the male part 1 but still not subjected to deformation forces, the O-ring groove 3g will still lie essentially outside the outer edge 1b of the male part 1. The O-ring 4 has no contact with the male part 1 in this initial position.

When tightening the pipe coupling, the coupling nut 2 (the female part) is screwed onto the male part 1 such as to press the rear part 2a of the nut 2 forwards against the rear part 3i of the bite ring 3, in a known manner. The forward part 3c of the bite ring will herewith be pressed with great force against the inner conical mantle surface 1a of the male part 1 and slide thereagainst, wherewith the edge 3b of the pointed part 3c will bite into the pipe 5 at the same time as the whole of the press-in part 3a located forwardly of the base plane B is successively deformed and/or pressed into the pipe. The inner conical surface 3h of the bite ring is thus pressed in against the pipe 5 during bending of the bite ring roughly in the base plane B, at the same time as the bite ring advances while the outer conical surface 3e of the bite ring and the inner conical surface 1a of the male part slide against one another. In the final moment of this movement, those parts of the conical mantle surface 3e that lie immediately forwards of and rearwardly of the O-ring groove 3g have still not come into direct contact with the inner conical surface 1a of the male part 1. This occurs when the rear wall 3j of the groove 3g has passed the front edge 1b of the male part 1. The O-ring 4 will also herewith come into contact with the inner mantle surface of the male part, which contact area has not been scored or scratched by sliding between metal surfaces and is therefore undamaged. It is possible that a certain, very slight amount of sliding may take place between the O-ring 4 and the inner conical surface 1a of the male part 1 at the very last moment, although no damage will be caused to the O-ring 4 because said surface is undamaged and free from scratches.

In the final stage, as in the ideal case shown in Fig. 2, the mantle surfaces 3e' and 3h' of the press-in part 3a' will lie essentially against the conical inner surface 1a of the male part 1 and against the pipe 5 respectively, the pointed part 3c' will be pressed into the pipe 5, and the O-ring 4 will lie sealingly against the inner mantle surface 1a of the male part and against the rear wall 3j of the O-ring groove 3g. Complete sealing is achieved with this coupling at pressures of up to at least 1500 bars.

CLAIMS

1. A pipe coupling comprising a threaded male part (1) having a part which includes an internal conical surface (1a) and an abutment edge (1c) for abutment with a pipe (5) to be connected to the male part, a threaded female part (2), and a bite ring (3) which is located between the male part and the female part and which includes a press-in part which is adapted to be pressed into the conical part of the male part as the male and female parts are screwed together, such that a front edge (3b) of the press-in part will bite into the pipe extending coaxially with the coupling, **characterized** in that the press-in part of the bite ring has provided externally thereof an annular groove (3g) for accommodating a sealing ring (4) which is pressed sealingly against the internal conical surface of the male part as the male and female parts are screwed together.

2. A pipe coupling according to Claim 1, wherein the press-in part of the bite ring comprises a front part which includes the pointed part having said front edge, and a rear part which extends along half the total axial length of the press-in part, **characterized** in that said annular groove is placed in said rear part.

3. A pipe coupling according to Claim 1 or 2, **characterized** in that the annular groove (3g) is at least partially visible outside the front edge (1b) of the threaded male part prior to the bite ring being pressed thereinto when screwing together the coupling.

4. A pipe coupling according to any one of Claims 1 - 3, **characterized** in that the bite ring is internally conical in the region between the pointed part, which shall bite into the pipe, and a rear cylindrical part with the imaginary apex of the conical surface pointing rearwardly; in that the bite ring has rearwardly of the pointed part an external conical mantle surface whose slope angle (v2) is smaller than the slope angle (v1) of the internal conical surface on the threaded male part; and in that the annular groove is placed forwardly of the base plane (B) perpendicular to the coupling centre line, where the internal conical part of the bite ring passes into a cylindrical surface.

5. A pipe coupling according to Claim 4, **characterized** in that the distance between the base plane (B) and the rear edge (3j) of the annular groove is smaller than the width of the groove.

6. A pipe coupling according to any one of Claims 1 - 5, **characterized** in that the sealing ring is comprised of an elastomer.

7. A pipe coupling according to Claim 6, **characterized** in that the sealing ring is an O-ring.

AMENDED CLAIMS

[received by the International Bureau on 14 November 1996 (14.11.96); original claims 1-7 replaced by amended claims 1-6 (2 pages)]

1. A pipe coupling comprising a threaded male part (1) having a part which includes an internal conical surface (1a) and an abutment edge (1c) for abutment with a pipe (5) to be connected to the male part, a threaded female part (2), and a bite ring (3) which is located between the male part and the female part and which includes a press-in part which is adapted to be pressed into the conical part of the male part as the male and female parts are screwed together, such that a front edge (3b) of the press-in part will bite into the pipe extending coaxially with the coupling, wherein the press-in part of the bite ring comprises a front part which includes the pointed part having said front edge, and a rear part which extends along half the total axial length of the press-in part, **characterized** in that said rear part of the press-in part of the bite ring has provided externally thereof an annular groove (3g) for accommodating a sealing ring (4) which is pressed sealingly against the internal conical surface of the male part as the male and female parts are screwed together.

2. A pipe coupling according to Claim 1, **characterized** in that the annular groove (3g) is at least partially visible outside the front edge (1b) of the threaded male part prior to the bite ring being pressed thereinto when screwing together the coupling.

3. A pipe coupling according to any one of Claims 1 - 2, **characterized** in that the bite ring is internally conical in the region between the pointed part, which shall bite into the pipe, and a rear cylindrical part with the imaginary apex of the conical surface pointing rearwardly; in that the bite ring has rearwardly of the pointed part an external conical mantle surface whose slope angle (v2) is smaller than the slope angle (v1) of the internal conical surface on the threaded male part; and in that the annular groove is placed forwardly of the base plane (B) perpendicular to the coupling centre line, where the internal conical part of the bite ring passes into a cylindrical surface.

4. A pipe coupling according to Claim 3, **characterized** in that the distance between the base plane (B) and the rear edge (3j) of the annular groove is smaller than the width of the groove.

5. A pipe coupling according to any one of Claims 1 - 4, **characterized** in that the sealing ring is comprised of an elastomer.

6. A pipe coupling according to Claim 5, characterized in that the sealing ring is an O-ring.

Fig.1.

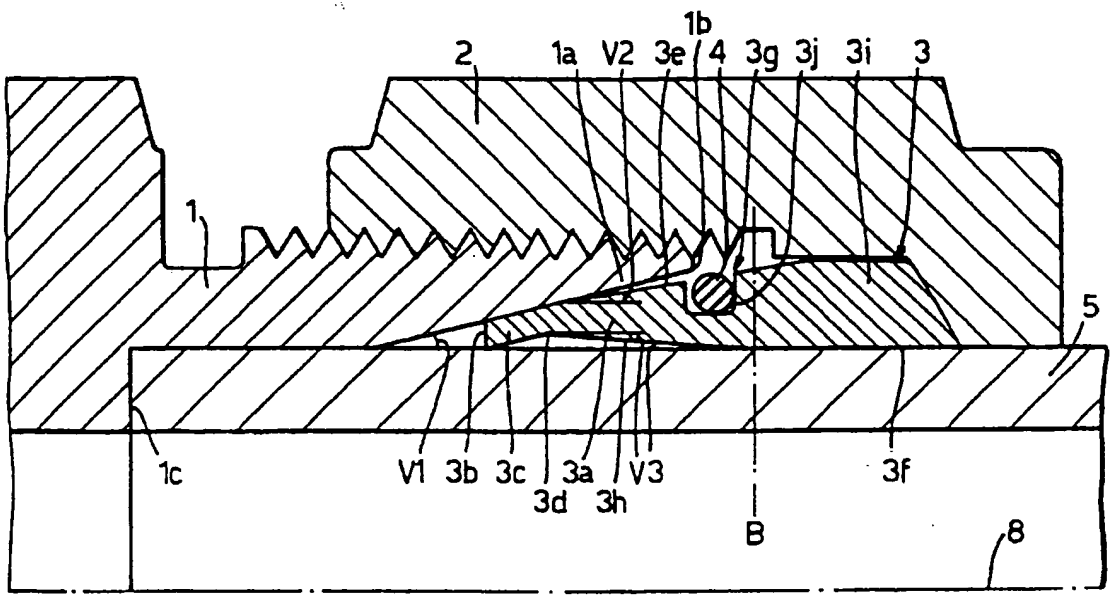
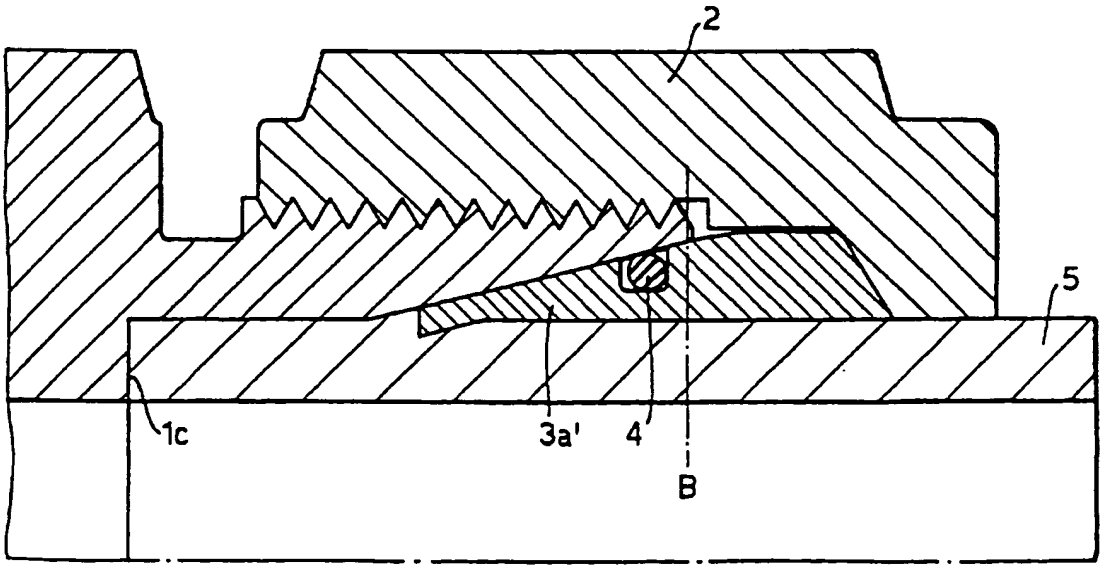


Fig.2.



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 95/01211

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: F16L 19/12
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	SE 333851 B (H KREIDEL OCH H KREIDEL), 29 March 1971 (29.03.71), figures 1-3 --	1-4,6
Y	WO 9325837 A1 (LEHMANN, KLAUS-DIETER), 23 December 1993 (23.12.93), page 8, line 24 - line 30, figures 3,4 --	1-4,6
A	SE 388920 B (ARMATURFABRIKEN HERMANN VOSS), 18 October 1976 (18.10.76) -- --------	

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

01/04/96

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE-B- 333851	29/03/71	NONE	
WO-A1- 9325837	23/12/93	NONE	
SE-B- 388920	18/10/76	AT-B- 324053	11/08/75
		AT-A,B- 335238	25/02/77
		BE-A,A- 792460	30/03/73
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		SE-B,C- 406362	05/02/79
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